AMENDMENTS TO THE CLAIMS:

This listing of the claims will replace all prior versions, and listings, of the claims in this application.

Listing of Claims:

1. (Currently Amended) A method to determine information indicative of at least one property of a physical entity by utilizing ~~a numerical solution of~~ a linear system of equations ~~representing a~~ to represent the physical entity, the method comprising:

generating a mesh representation of the physical entity, wherein the mesh representation ~~comprising~~ comprises a plurality of mesh elements;

computing a linear system matrix A of coefficients by computing interactions between simple functions defined over sets of mesh elements;

partitioning the mesh representation into a plurality of partitions separated by partition boundaries, wherein each partition comprises at least one mesh element of the plurality of mesh elements, wherein at least one partition comprises at least two mesh elements of the plurality of mesh elements;

computing, using at least the plurality of partitions, a preconditioner for the linear system matrix A, wherein the preconditioner ~~that~~ is compatible with the linear system of equations and ~~that~~ provides at least basis function support over at least two mesh elements, where coupling of the preconditioner between partitions is only through basis functions at the partition boundaries; ~~and~~

using at least the linear system matrix A and the preconditioner, determining an approximate numerical solution of the linear system of equations, wherein the approximate numerical solution comprises the information indicative of at least one property of the physical entity, wherein the at least one property comprises one of a fluid mechanical property, an acoustical property or a field scattering property of a radar-related component; and

outputting the approximate numerical solution.

2. (Currently Amended) A method as in claim 1, where the preconditioner is itself a valid solution to ~~the~~ a same set of physical equations that govern the full linear system of equations.

3. (Original) A method as in claim 1, where computing a preconditioner operates to compute a preconditioning matrix K where partition boundaries are constrained to coincide with the edges of mesh elements, and to compute mesh element interactions using reduced coupling.

4. (Original) A method as in claim 3, where mesh element interactions between basis functions are computed only for half functions within the same partition, where a half function denotes the function over any one of multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.

5. (Original) A method as in claim 4, further comprising sorting indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:

$$K = \begin{bmatrix} [Ka_1] & & & & \\ & [Ka_2] & & & [Kb] \\ & & \ddots & & \\ & & & [Ka_n] & \\ & [Kc] & & & [Kd] \end{bmatrix},$$

where the sub matrix *Ka* is the block diagonal matrix created by the union of the matrices of internal element interactions Ka_1 through Ka_n, *Kd* represents the interactions between the boundary elements, and *Kb* and *Kc* are the interactions between the internal and boundary elements.

6. (Previously Presented) A method as in claim 5, wherein determining an approximate numerical solution further comprises iteratively solving a system of equations $Ax=f$ using the linear system matrix A, a vector f of boundary conditions on each mesh element and the preconditioner matrix K to provide an approximate solution x.

7. (Original) A method as in claim 6, where the linear system matrix A is partitioned in the same manner as the preconditioner using the same partitions, separate partitions, or a combination of the same and separate partitions.

8. (Original) A method as in claim 6, where iteratively solving comprises operating a conjugate gradient iterative solver.

9. (Currently Amended) A computer readable medium tangibly embodying a program of machine-readable instructions executable by a digital processing device to perform operations to ~~compute a numerical solution of~~ determine information indicative of at least one property of a physical entity by utilizing a linear system of equations ~~representing a~~ to represent the physical entity, the operations comprising:

generating a mesh representation of the physical entity, wherein the mesh representation ~~comprising~~ comprises a plurality of mesh elements;

computing a linear system matrix A of coefficients by computing interactions between simple functions defined over sets of mesh elements;

partitioning the mesh representation into a plurality of partitions separated by partition boundaries, wherein each partition comprises at least one mesh element of the plurality of mesh elements, wherein at least one partition comprises at least two mesh elements of the plurality of mesh elements;

computing, using at least the plurality of partitions, a preconditioner for the linear system matrix *A*, wherein the preconditioner ~~that~~ is compatible with the linear system of equations and ~~that~~ provides at least basis function support over at least two mesh elements, where coupling of the preconditioner between partitions is only through basis functions at the partition boundaries; ~~and~~

using at least the linear system matrix A and the preconditioner, determining an approximate numerical solution of the linear system of equations, wherein the approximate numerical solution comprises the information indicative of at least one property of the physical entity; and

outputting the approximate numerical solution.

10. (Currently Amended Presented) A computer readable medium as in claim 9, where the preconditioner is itself a valid solution to ~~the~~ a same set of physical equations that govern the full linear system of equations.

11. (Previously Presented) A computer readable medium as in claim 9, where computing a preconditioner operates to compute a preconditioning matrix *K* where partition boundaries are constrained to coincide with the edges of mesh elements, and to compute mesh element interactions using reduced coupling.

12. (Previously Presented) A computer readable medium as in claim 11, where mesh element interactions between basis functions are computed only for half functions within the same

partition, where a half function denotes the function over any one of multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.

13. (Previously Presented) A computer readable medium as in claim 12, further comprising sorting indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:

$$K = \begin{bmatrix} [Ka_1] & & & & \\ & [Ka_2] & & & [Kb] \\ & & \ddots & & \\ & & & [Ka_n] & \\ & [Kc] & & & [Kd] \end{bmatrix},$$

where the sub matrix Ka is the block diagonal matrix created by the union of the matrices of internal element interactions Ka_1 through Ka_n, Kd represents the interactions between the boundary elements, and Kb and Kc are the interactions between the internal and boundary elements.

14. (Previously Presented) A computer readable medium as in claim 13, wherein determining an approximate numerical solution further comprises iteratively solving a system of equations $Ax=f$ using the linear system matrix A, a vector f of boundary conditions on each mesh element and the preconditioner matrix K to provide an approximate solution x.

15. (Previously Presented) A computer readable medium as in claim 14, where the linear system matrix A is partitioned in the same manner as the preconditioner using the same partitions, separate partitions, or a combination of the same and separate partitions.

16. (Previously Presented) A computer readable medium as in claim 14, where iteratively solving comprises operating a conjugate gradient iterative solver.

17. (Currently Amended) A digital processing system operable to ~~compute a numerical solution of~~ determine information indicative of at least one property of a physical entity by utilizing a linear system of equations ~~representing a~~ to represent the physical entity, the digital processing system comprising:

a generator configured to output a mesh representation of the physical entity, wherein the mesh representation ~~comprising~~ comprises a plurality of mesh elements;

a first computation function configured to compute a linear system matrix A of coefficients by computing interactions between simple functions defined over sets of mesh elements;

a partitioner configured to partition the mesh representation into a plurality of partitions separated by partition boundaries, wherein each partition comprises at least one mesh element of the plurality of mesh elements, wherein at least one partition comprises at least two mesh elements of the plurality of mesh elements;

a second computation function configured to compute, using at least the plurality of partitions, a preconditioner for the linear system matrix A, wherein the preconditioner ~~that~~ is compatible with the linear system of equations and ~~that~~ provides at least basis function support over at least two mesh elements, where coupling of the preconditioner between partitions is only through basis functions at the partition boundaries;~~and~~

a solver configured to determine, using at least the linear system matrix A and the preconditioner, an approximate numerical solution of the linear system of equations, wherein the approximate numerical solution comprises the information indicative of at least one property of the physical entity; and

an output configured to return the approximate numerical solution.

18. (Currently Amended) A digital processing system as in claim 17, where the computed preconditioner is itself a valid solution to ~~the~~ a same set of physical equations that govern the full linear system of equations.

19. (Original) A digital processing system as in claim 17, where said second computation function operates to compute a preconditioning matrix K where partition boundaries are constrained to coincide with the edges of mesh elements, and to determine mesh element interactions using reduced coupling.

20. (Original) A digital processing system as in claim 19, where said second computation function computes mesh element interactions between basis functions only for half functions within the same partition, where a half function denotes the function over any one of multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.

21. (Original) A digital processing system as in claim 20, where said second computation function operates to sort indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:

$$K = \begin{bmatrix} [Ka_1] & & & & \\ & [Ka_2] & & & [Kb] \\ & & \ddots & & \\ & & & [Ka_n] & \\ & [Kc] & & & [Kd] \end{bmatrix},$$

where the sub matrix Ka is the block diagonal matrix created by the union of the matrices of internal element interactions Ka_1 through Ka_n, Kd represents the interactions between the boundary elements, and Kb and Kc are the interactions between the internal and boundary elements.

22. (Previously Presented) A digital processing system as in claim 21, wherein the solver further comprises an iterative solver operable to solve a system of equations $Ax=f$ using the linear system matrix A, a vector f of boundary conditions on each mesh element and the preconditioner matrix K to provide an approximate solution x.

23. (Previously Presented) A digital processing system as in claim 22, where the linear system matrix A is partitioned in the same manner as the preconditioner using the same partitions, separate partitions, or a combination of the same and separate partitions.

24. (Original) A digital processing system as in claim 22, where said iterative solver comprises a conjugate gradient iterative solver.